lished with those observed by others, in such a way that the results will form a portion of the whole structure of science. In other words, the investigator must be able to generalize or do hack work. Without generalization there would be no sciences, and the present comity existing between kindred disciplines would be absent. Observations, however carefully carried out, are not research, and it is wrong to call the mere observer a research worker.

The logical result of the above argument is that the student, in order to accomplish anything as an original worker, must clearly realize the necessity, not only of a thorough understanding of his own subject and of the allied branches, but also the importance of a good substratum of general culture. The more a man has used his brain as an apparatus for thinking, the more he will be able to do in research. For this reason the undergraduate should not be too anxious to specialize. Let him, perhaps during his four years' course, obtain some insight into the underlying facts and theories of his chosen science, but, of all things, let him beware of neglecting the opportunity of familiarizing himself with the world which surrounds both him and the subject to which he intends to devote himself.

The undergraduate who really means to accomplish something, makes no greater mistake than to suppose himself able to do without graduate work. All beginners are dependent on their teachers, the advanced student should learn to depend upon himself, and this end can only be reached after the necessary preliminary routine is completed.

An undergraduate can not be expected to master the necessary details of a profession. He must and will be an amateur. If he really loves the subject he has chosen he certainly should be willing and anxious to prepare himself for further development by graduate study. Here, too, the brief time given to obtaining the master's degree is not sufficient for any valuable results in research; nor, indeed, if the student has properly used his time during the preliminary period of training, will he be prepared to properly launch himself in the higher fields of original investigation. He had far better devote the interval given to the intermediate degree to acquainting himself with the necessary details of his chosen subject, with its relations to other sciences and to gaining as good an insight as possible into its literature and history. In this way the worker will discover in what portion of the field an original investigation can be carried on, understand its relative importance, and comprehend the way in which it is related to the whole structure of which it is to form a part. A man so trained may do something worthy of the doctorate and also worthy of the vast field of scientific thought into which he has entered.

Above all, no one should strive to begin scientific work actuated solely by mercenary considerations. The question is too often asked: Where can I apply this to some practical end? How can I make money out of this subject? No more blighting influence to scientific development can be imagined. It deprives science of the very essence of its existence—the universal comity of knowledge—it changes that which might be for the good of all into something for the benefit of the individual pocketbook; it retards rather than accelerates growth. The history of each individual case is but a repetition of the universal history of science. A premature attempt to apply what he has acquired to practical ends simply results in robbing the student of his power for further development. It leaves him where he stands for all time to come, and his more studious brethren will soon pass and distance him, regardless of the fact that his immediate pecuniary gain may be greater.

The sciences of to-day form a body of great generalizations, none of which have come to us through the efforts of one man; they are, on the contrary, a result of gradual growth in each step of which the mental acumen of some investigator, perhaps long since dead, can be seen, and each research of to-day is built upon some perhaps equally great one of yesterday. Science is a stern mistress who gives of the best within her only to those who follow her unflinchingly, however difficult the task, however remote the prospect of pecuniary gain or of self-aggrandizement, their sole hope being that they, too, may add to mankind's knowledge of truth, so that future generations may profit by the sacrifices of the present. This has been the spirit of the past; it must also be the spirit of the present and of the future. Science is moving onward, swiftly, relentlessly, unflinchingly; no half-hearted followers for her; the weak fall by the wayside; there is no place for those who have not the patience to acquire the necessary knowledge. The strong press forward in fierce rivalry, each striving for the ultimate goal, a perfect human knowledge by which from any given premises the logical conclusion may be drawn with unerring accuracy.

CLIMATE AND FLORA.

Mr. Thomas H. Kearney, Jr., has published in Science a series of articles on the plant geography of North America. In that journal for November 30, Vol. XII, pp. 840–842, he gives expression to some of the "conditions of climate and soil which permit the actual existence of numerous lower austral forms in juxtaposition to a transition and even Canadian flora." He believes the factors that have the largest effect in determining the zonal distribution of organisms are (1) the normal number of days during the year which possess a temperature of the air above 6° C., or 43° F.; (2) the normal sum total of temperatures above 6° C.; (3) the normal mean of the six consecutive hottest weeks. The following table gives the values of this data for four stations in the mountain region and two of the most northern stations in the Austro-riparian area. The two additional factors of importance, permitting species to maintain themselves in what would seem to be an unfriendly environment, are (4) the amount of insolation as to duration and intensity; (5) the nature of the soil. As the items 1–4 are already computed for many Weather Bureau stations, it would seem possible to make an extended inquiry along the lines suggested by Mr. Kearney.

Stations.	Altitudes.	Days with temperature above 43° F.	Sum total above 43° F.	Normal mean of six hottest weeks.
	Feet.	*Days.*	° F.	° F.
Highlands, N. C	3,817	234	3,547	66.1
Asheville, N. C	1,981-2,250	249	4,688	71.3
Knoxville, Tenn.	891- 933	267	5,563	76.1
Valleyhead, Ala	1,027	293	5,488	75.2
Norfolk, Va	11- 12	295	6,047	79.3
Memphis, Tenn	117- 273	307	6,754	81.0

HEAVIEST RAINFALL AT LA CROSSE, WIS.

Mr. R. H. Dean, Observer, Weather Bureau, at La Crosse, Wis., reports that the rainfall on the 27th and 28th exceeded all previous records for twenty-four hours at that station. He has compiled the following table, showing the amount and date of the greatest daily rainfalls in each month since 1871, inclusive. The record of 7.23 inches on October 27–28, 1900, occurred in twenty-two hours and eighteen minutes, between 10:12 a. m. of the 27th and 8:30 a. m. of the 28th:

	Inches.
January 28 and 29, 1891	1.32
February 27, 1876	1.10
March 27, 1880	2.05
April 27 and 28, 1889	1.66
May 14 and 15, 1900	1.90
June 11 and 12, 1899	4.91
July 14, 1900	4.12
August 7 and 8, 1889	4.25
September 6 and 7, 1884	5.69
October 29 and 30, 1896	2.41
October 27 and 28, 1900	7.23
November 10, 1880	1.74
December 24 and 25, 1895	2.11

METEOROLOGICAL CABLEGRAMS.

On page 248 of the MONTHLY WEATHER REVIEW for June, 1900, we have given in full the title of the Atlantic Cable Directory for the convenience of those who have occasion to transmit to the Weather Bureau meteorological information from foreign countries by cable or telegraph. As this work is no better known than several other systems of cable cipher, we append also the following titles of other works, and would say that any dispatch for the Weather Bureau may be sent in any system of cipher that is most convenient to the author, provided it has been published, with confidence that the Weather Bureau will be able to decipher it as all ordinary cable codes are at hand or available for this use. Among the codes most used in America and Europe are the following:

No. 1, The Atlantic Cable Directory, already referred to.

No. 2, Western Union Telegraphic Code and International Cable Directory, compiled and published by the International

Cable Directory Company, New York. Cable address, "Incadice," Telephone, 1555 Broad. Copyrighted in the United States and registered in Great Britain (entered at Stationers' Hall); 1899.

No. 3, The A B C Universal Commercial Electric Telegraphic Code, specially adapted for the use of financiers, merchants, shipowners, brokers, agents, etc.; multum in parvo; simplicity and economy palpable; secrecy absolute, by W. Clauson-Thue, F. R. G. S.

Fourth Edition, London: Eden Fisher & Co., 50 Lombard street and 97 Fenchurch street, E. C., 1883. Registered in Great Britain and Colonies, United States, Belgium, France, and Germany; all rights strictly reserved. Price 15s.; or, interleaved with plain paper, 20s. net. By Parcels Post, 15s. 6d. By Continental Book Post, 16d. or 21s. 6d. An india rubber stamp is given with each book.—A B C Code used.

No. 4, Lieber Code. Published in English and French by the Lieber Code Co., New York and London. Cable address "Rebeil." Copyrighted in the United States, and registered in France, Great Britain, and colonies. Especially adapted for banking, mining, legal, shipping, and mercantile business. A rubber stamp given to each code.—Lieber's Code used.

It contains 75,000 code words consecutively numbered.

Every three months a list up to date of those having the code is sent to all purchasers.

PSYCHROMETRIC TABLES.

In the MONTHLY WEATHER REVIEW for August, page 333, Mr. W. H. Alexander states that Molesworth's psychrometric tables were used by his correspondents in reducing their observations of the wet and dry bulb thermometer. In reply to an inquiry by the Editor, Mr. Alexander states that he has not been able to find a copy of these tables in St. Kitts, but has obtained a manuscript copy of the table actually used under Mr. Watts's direction. This is copied from Hurst's Handbook for Surveyors, and is identical with the tables of dew-point factors published by Glaisher in 1856, and which the reader will find reprinted on page 144 D of the Smithsonian Meteorological Tables, third edition, 1859. These factors are still used by English observers, and, in some cases, give approximate results if the psychrometer is not ventilated or exposed to a strong wind. In order to obtain the best results with the psychrometer, it must be ventilated at the rate of 5 to 10 feet per second and the corresponding tables first prepared by Ferrel and slightly amended by Assmann, Svensson, Marvin, and others must be used.

OBSERVATIONS DURING THE SOLAR ECLIPSE.

The observations at one hundred and fifty-four meteorological stations in India recorded during the solar eclipse of January 22, 1898, have been discussed and published by Mr. John Eliot, the Director General of Indian observatories, in a recent Indian meteorological memoir. The observations included the temperature of the air, barometric pressure, relative humidity, cloud and rainfall at all stations and solar radiation observations at six stations. The solar radiation thermometer is so much affected by the radiation from the surrounding inclosure and by the wind, as well as by its own sluggishness, that it must not be considered as an instrument for measuring solar radiation proper, but may, possibly, give us a fair indication of the changes in temperature of leaves and other objects exposed to the sunshine. The difference between the readings of the solar radiation thermometer and the dry bulb or air temperature in the shade, were directly proportional to the area of the unobscured portion of the disc of the sun. The temperature of the surface of the ground was observed in isolated cases; the amplitude of the change in the interior of India was from 12° to 20° at the time of maximum obscuration. The temperature of the air diminished in proportion to the obscuration and amounted to 8° in the interior of India near the path of total eclipse. The maximum reduction of temperature was 12° at Karwar and the epoch of the greatest diminution of temperature averaged about twenty-three minutes later than the epoch of greatest obscuration. Mr. Eliot suggests that this large amount of retard may have depended somewhat upon inaccurate observations in the dim eclipse light, but it was practically the same over the whole area in which the sun's disc was obscured by eight-tenths or more. With regard to the barometric pressure Mr. Eliot states that there was a steady increase of pressure proceeding at a nearly uniform rate during the first stage of the eclipse; there was little or no variation during the second stage and, finally, during the restoration of sunlight an increase of pressure that continued after the termination of the eclipse.

The chief effects of these actions were (*a*) to decrease the amplitude of the diurnal variation on the day of the eclipse by amounts averaging about 0.035 inches in and near the belt of totality; (*b*), to accelerate the epoch of the afternoon minimum of the diurnal oscillation on the day of the eclipse by intervals averaging about forty-five minutes. The motion of the air was very considerably modified in amount and intensity, but not in direction; it fell off very rapidly during the first stage and was feeble during the greater part of the second stage. Light airs and calms prevailed during the time of greatest obscuration at an hour when the diurnal variation of the wind gives us the greatest velocity. At the majority of stations and near the belt of totality a short sudden gust occurred at twenty minutes after the commencement of the eclipse. This is shown at a large number of stations; the recorded velocity of the gusts varied between 10 and 26 miles per hour; at the first class stations the gust occurred one or two hours before the eclipse at 3 stations, but after the beginning at 10 stations; the gusts show a fairly regular progress from west to east. At twelve second and third class stations, in or near the belt of totality, the gusts occurred before the eclipse in four cases. On the average of all the 38 stations at which anemometers were used the mean air movement between 1 and 2 p. m., was only a third of that which prevailed during the preceding hour, and was even less than the movement in the early morning hours at the time of the diurnal minimum wind. In general, a series of gusts occurred about twenty minutes after the commencement of the eclipse and another series about half an hour after totality. The day was remarkably clear, and the atmosphere steady, and upward convective movements were feeble, more especially during the eclipse, when they were *nil*. There was a large and rapid increase of the pressure of aqueous vapor, and hence also of relative humidity commencing on an average about twenty minutes after totality, followed by an equally large and rapid decrease for about thirty minutes. This oscillation occurred at all stations without exception during the second half of the eclipse and was the most remarkable and unexpected phenomenon of all. The data at hand show clearly that this oscillation in humidity was transmitted from west to east with approximately the same velocity as that of the shadow of the moon; it was not due to an actual horizontal movement of the air, but passed across India with the shadow itself. It could not have been due to the ordinary processes of evaporation or diffusion of moisture, or to the slow horizontal movement of the air, as shown by the anemometer; the only action which could give rise to this oscillation is the descent of masses of air containing a larger quantity of aqueous vapor than the air at the surface. Mr. Eliot considers